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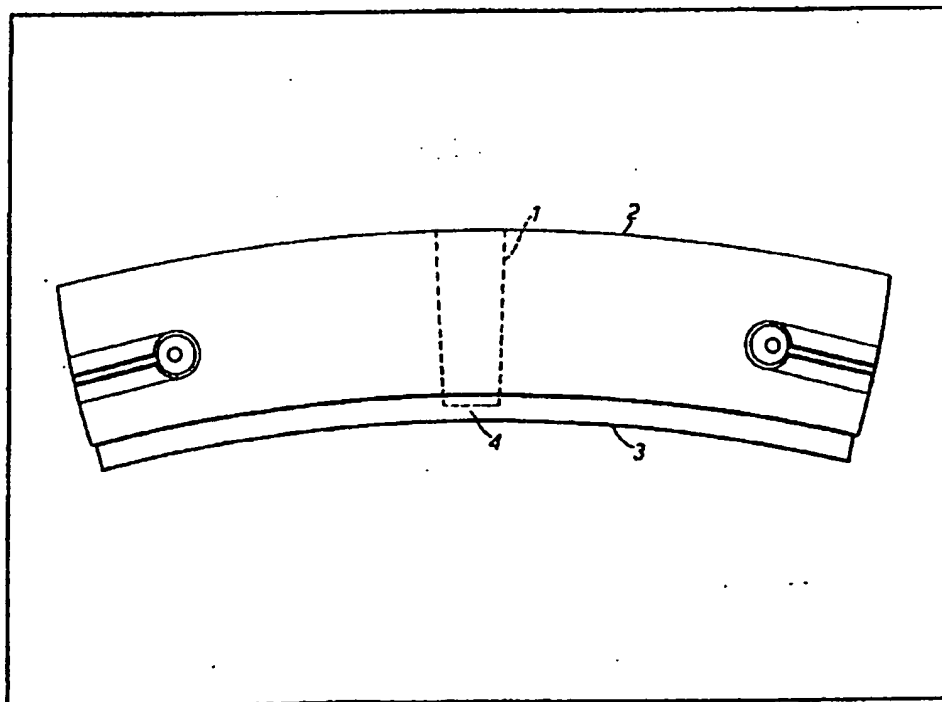
(54) Tunnel Linings

(57) A tunnel lining segment is provided at its mid-length with a blind bore 1 open to the outside and stopping short of the inside surface, which is provided with a visible

marking in registry with the blind bore. The remaining wall thickness at the inner end of the bore can be broken out or drilled to enable grouting to take place.

The invention is also applicable to underground pipe sections.

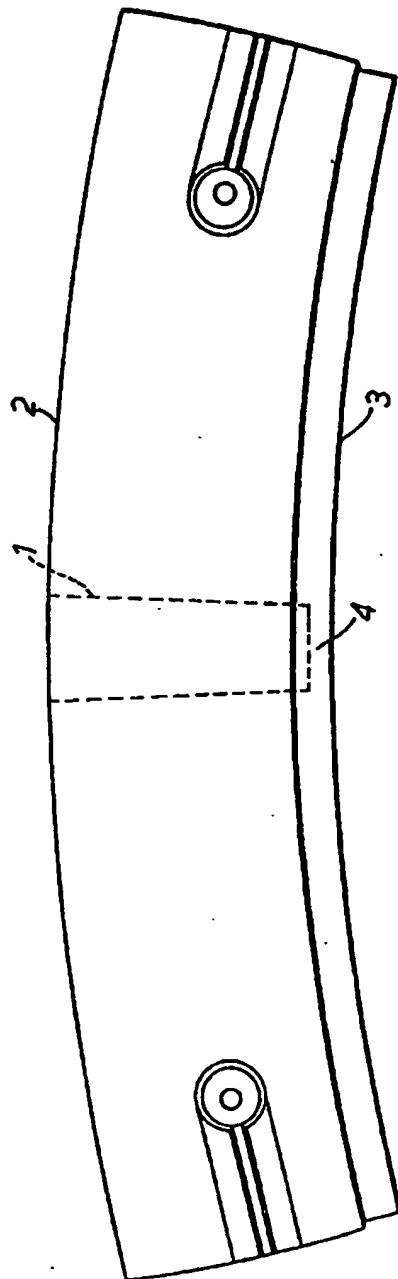
The drawings originally filed was informal and the print here reproduced is taken from a later filed formal copy.



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## SPECIFICATION

## Underground Pipes and Tunnel Linings

This invention relates to underground pipes and tunnel linings. Tunnel linings are commonly formed by abutting rings or annular sections, each formed by a number of part annular segments.

Two main types of construction are in current use. In the "expanded" type, the segmented rings are effectively expanded to fill an accurately formed excavation, so that in the finished installation there are substantially no voids between the tunnel lining and the excavation.

In the "grouted" type, an annular void is left between the assembled lining and the excavation, and this void is filled (i.e. grouted) by injecting a suitable filling material into the void through grouting holes provided for this purpose in some or all of the segments. The grouting hole must be made good after grouting to leave a smooth surface at the interior of the lining.

The present invention provides a tunnel lining segment formed with a blind bore open at the outer face of the segment and stopping short of the inner face and having a visible identification mark on the inner face of the segment registering with the bore.

Segments of this construction can therefore be used in construction of the expanded type or the grouted type, and when used in the latter type, the remaining wall thickness at the inner end of the blind bore is merely broken away to form a grouting hole for injection of filling material.

Additionally, however, in the case of an expanded lining, it sometimes happens that unintended voids are created in the soil surrounding the lining due to overbreak during excavation, i.e. the unintentional removal of soil beyond the limit of the required tunnel bore. In this case, some of the blind holes may be broken out to permit localised grouting.

The invention thus makes it possible if desired to standardise the design and production of lining segments for use either in expanded linings or in grouted linings.

Tunnel segments as described above are usually made of concrete but those skilled in the art will recognize that the invention is applicable to segments of other structural materials.

One particular form of concrete tunnel lining segments in accordance with the invention is described below, by way of example, with

reference to the accompanying drawing, which shows the segment in end elevation.

The segment is formed, preferably and as shown at its mid-length, with a blind bore 1 open at the convex outer surface 2 of the segment but stopping short of the concave inner surface 3 to leave a reduced wall thickness 4. The inner surface is marked with a visual identification of any convenient form in registry with the bore 1.

For use in an expanded lining construction the blind bore 1 is redundant and the segment has the requisite smooth and continuous inner surface. When the segment is employed in a grouted construction the reduced wall portion 4 is broken away e.g. by drilling, to open up a grouting hole, the inner end of which is filled, after grouting has been completed to make good the inner surface of the completed tunnel lining.

The invention is also applicable to pipes. For example, pipes may be laid in a trench and jointed end to end, and the trench backfilled. If the joints should leak, soil may be washed into the pipe, leaving voids, outside it. In such a case, the voids may be sufficiently large to make grouting desirable, and by making the pipes with blind holes in the manner described above localised grouting can be effected by selective breaking out of the holes.

In another constructive technique, pipes are thrust into the soil from the bottom of a pit, soil being excavated at the leading end of the pipe work and further pipes being added at the rear end, at the pit, as excavation proceeds. In such an installation the excavated bore is usually oversized to ease the passage of the pipe sections through the ground. The resultant void or voids may then be grouted by breaking out the blind holes as in the case of a grouted tunnel lining.

## 90 Claims

1. A tunnel lining segment or pipe section having a blind bore open at its outer, convex face and stopping short of the inner face, and having a visible identification mark on the inner face in registry with the blind bore.

2. A tunnel lining segment according to claim 1 wherein the blind bore is formed at the mid-length of the segment.

3. A tunnel lining segment substantially as herein described with reference to the accompanying drawing.